# Transportation

## vehicles for the future

Automobiles, aircraft, trucks, and vehicles of all types are essential to transportation in today's global community. But transportation also consumes a major portion of the world's energy and creates major environmental concerns. To continue moving people and goods from one place to another in the next century, we need vehicles that last longer, use energy more efficiently, and don't pollute the environment.

Developing and evolving vehicles to meet these critical goals require integrating complex assemblies of advanced materials, computer controls, and better fuel and emissions systems. BES is supporting these efforts through the science that enables these evolving technologies. Using alloy design, for example, scientists are developing new materials for magnets. In turn, these magnets are used in a variety of the sensors and small motors for power steering and other vehicle functions.

At BES user facilities, neutron beams probe the molecular arrangement of the rubber used in tires. The goal is to reduce the buildup of tire heat while in use — and thus increase fuel efficiency. Additionally, researchers are applying expertise in characterization and modeling to develop environmentally safe coatings that inhibit corrosion and rusting in car parts.

For aircraft and automobiles, wear-resistant coatings are being designed that build on basic science understanding of erosion. BES-developed technologies also provide a foundation for highly sensitive tools to analyze automobile emissions and guide the development of ultralow-emission vehicles.

Computers are also playing a key role. Automobile components are being engineered with guidance from computer models that optimize design — from auto body panels with reduced weight to taillights with nearly ideal optical properties. Aided by new parallel supercomputers, scientists are simulating faster and more accurate car crashes and using those data to design vehicles with improved safety features. The next generation of vehicles is coming, and BES is helping to pave the way.

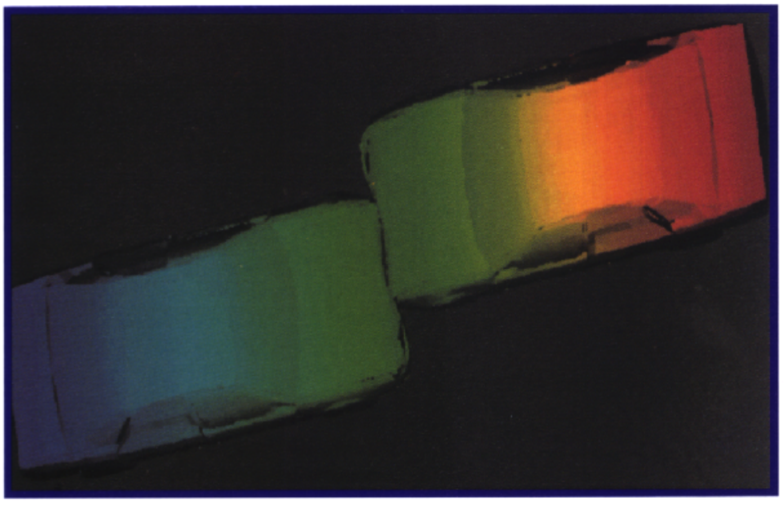

**Erosion and wear at high operating temperatures are major problems in engines in many transportation systems. Joint research between Argonne National Laboratory and AlliedSignal has improved the coatings technologies used in anodized aluminum for reducing erosion and wear in jet aircraft castings. This collaboration also includes the development of new silicon nitride ceramics for engine components. The extensive analytical expertise at Argonne has played an important role in these developments.**

# Ultrasensitive Detectors

An advanced ion trap mass spectrometer system, developed at Oak Ridge National Laboratory, is being commercialized by Teledyne Corporation for environmental analyses and explosives detection. This system also has a major role in a joint research effort (funded by the Advanced Energy Projects and Technology Division) with the U.S. auto industry to develop advanced technologies to measure automobile emissions in real time.

# Efficient Optics

Optical collectors, now being used by Ford for taillights in Thunderbirds, are based on designs developed by basic research at the University of Chicago. These designs enhance light concentration by more than a factor of 4 compared to traditional focusing techniques.

# Computer Simulations

To design better, safer, and more crashworthy cars, computer modeling is becoming increasingly important. Modeling reduces the need to conduct crash tests with real cars (these tests can cost as much as $750,000). However, using computers to simulate crashes takes a long time — typically several weeks. BES adapted new codes for the new massively parallel architecture supercomputers at Oak Ridge National Laboratory. With this new, faster computing capability, the run time for the crash model shown here was reduced to less than 26 hours. This modeling effort, which was a collaboration with the Department of Transportation, was the first automobile crash simulation performed with a parallel computer.